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TITLE: METHOD AND SYSTEM FOR PROVIDING A CARPOOL SERVICE USING A TELEMATICS SYSTEM

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METHOD AND SYSTEM FOR PROVIDING A CARPOOL SERVICE USING A TELEMATICS SYSTEM

FIELD OF THE INVENTION

This invention relates generally to data transmission over a wireless communication system. More specifically, the invention relates to a method and system for providing carpool service to wireless communication device users.

BACKGROUND OF THE INVENTION

Wireless communication services for mobile vehicles, such as navigation and roadside assistance, have increased rapidly in recent years. Global Positioning System (GPS) satellite technology has played an important part in these services. With the aid of GPS technology, the position of a vehicle may be determined at any time.

A substantial portion of any driver's time is spent on frequently traveled routes, such as the driver's daily commute to work or school. Often, the route to work or school is traveled using roads with heavy traffic. The periods of heavy traffic usually coincide with a person's daily commute. In many communities there has been a concerted effort to reduce the number of vehicles on the road during peak travel times. These efforts largely consist of encouraging commuters to carpool. What is lacking in many of these efforts is an organized efficient system of bringing together potential carpoolers leading to no reduction of the number of vehicles on the road. A better system for linking carpoolers together would alleviate some of the congestion that occurs during normal commuting hours. More importantly, reducing the number of vehicles on the road leads to a reduction of exhaust pollutants that are harmful to the environment.

Therefore, it would be desirable to provide a method and system for uploading of vehicle routes for carpool assistance that overcomes the aforementioned and other disadvantages.

SUMMARY OF THE INVENTION

One aspect of the invention provides a method for providing car-pooling assistance using a wireless communication system. The method includes steps for receiving a user carpool enrollment request, obtaining the positional information of the user's moving vehicle, storing the positional information as a route in a call center database and sending at least one available match based on the carpool enrollment request to the user.

Another aspect of the invention provides a computer usable medium including a program for providing car-pooling assistance using a wireless communication system. The program may include computer program code for receiving a user carpool enrollment request, computer program code for obtaining the positional information of the user's moving vehicle, computer program code for storing the positional information as a route in a call center database and computer program code for sending at least one available match based on the carpool enrollment request to the user.

Another aspect of the invention provides a system including means for receiving a user carpool enrollment request, means for obtaining the positional information of the user's moving vehicle, means for storing the positional information as a route in a call center database and means for sending at least one available match based on the carpool enrollment request to the user.

The aforementioned, and other features and advantages of the invention, will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of one embodiment of a system for providing car-pooling assistance using a wireless communication system, in accordance with the current invention; and

FIG. 2 is a flow diagram of one embodiment of a method providing car-pooling assistance using a wireless communication system, in accordance with the current invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

FIG.1 shows an illustration of one embodiment of a system for providing car-pooling assistance using a wireless communication system, in accordance with the present invention at **100**.

Carpool assistance system **100** may contain one or more mobile vehicles **110**, one or more wireless carrier systems **120**, one or more communication networks **125**, one or more land networks **140**, and one or more call centers **150**. Call center **150** may contain one or more switches **151**, one or more data transmission devices **152**, one or more communication services managers **153**, one or more communication services databases **154**, one or more advisors **155**, and one or more bus systems **156**. Call center **150** provides information to Web site **160**.

Carpool assistance system **100** may also include one or more client, personal or user computers **170**. Communication network **125** may connect wireless carrier system **120** to user computer **170** and call center **150**.

Client, personal or user computer **170** includes a computer usable medium that executes Internet browser and Internet-access computer programs to send and receive data over communication network **125** to call center **150**. User computer **170** sends a message with attached location information through a web-page interface using communication standards such as hypertext transport protocol (HTTP) and transport-control protocol and Internet protocol (TCP/IP).

Mobile vehicle **110** includes a telematics unit **115**. Telematics unit **115** may include a digital signal processor (DSP) **122** connected to a wireless modem **124**, a global positioning system (GPS) receiver or GPS unit **126**, an in-vehicle memory **128**, a microphone **130**, one or more speakers **132**, and wireless vehicle communication device **134**. DSP **122** may also be referred to as a microcontroller, controller, host processor, or vehicle communications processor. In-vehicle phone **134** may be an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone.

The wireless vehicle communication device **134** may be an embedded or in-vehicle phone, such as an analog or digital phone, with suitable hardware and software for transmitting and receiving data communications. Mobile vehicle **110** may contain a wireless modem **124** for transmitting and receiving data. The data may represent a real-time recording of a traveled route.

Global positioning system unit **126** is capable of determining synchronized time and a geophysical location of the mobile vehicle. The GPS unit **126** provides longitude and latitude coordinates of the vehicle. The GPS unit **126** may be the source of positional information for the vehicle that is obtained at set time intervals. Other sources of the positional information may be location technologies such as time difference of arrival (TDOA), angle of arrival (AOA), cell of origin (COO), location pattern matching, or visual landmark recognition. Global positioning system unit **126** also provides coordinated date and time information for a recorded route traveled. In one embodiment, the GPS unit **126** time and date stamps the route information as the user travels the route to be recorded. In another embodiment, the GPS unit **126** time stamps the route to be recorded. The date and/or time stamp provides additional information for the route to be recorded and used for the carpooling service.

DSP **122** executes various computer programs and computer program code that control programming and operational modes of electronic and mechanical systems within telematics unit **115**. DSP **122** controls communications between telematics unit **115**, wireless carrier system **120**, and call center **150**. A voice-recognition application may be installed in DSP **122** that can translate human voice input through microphone **130** to digital signals. For example, programming of in-vehicle phone **134** may be controlled with verbal commands that are translated by voice-recognition software executed by DSP **122**. Alternatively, buttons on an interface of telematics unit **115** or in-vehicle phone **134** may be used to change a phone number and other phone configuration settings. The interface to telematics unit **115** may include one or more buttons on the telematics unit, radio console, or associated keyboard or keypad. The interface to telematics unit **115** may include other forms of preference and data entry including touch-screens, wired or wireless keypad remotes, or other wirelessly connected devices such as Bluetooth-enabled devices.

DSP **122** may activate various programming and operation modes, as well as provide for data transfers. Signals from DSP **122** may be translated into voice messages and sent out through speaker **132**. One of the generated voice messages may include instructions given when a user has requested and entered a programming mode of in-vehicle phone **134**.

Mobile vehicle **110** via telematics unit **115** may send and receive radio transmissions from wireless carrier system **120**. Wireless carrier system **120** may be any suitable system for transmitting a signal from mobile vehicle **110** to communication network **125**.

Mobile vehicle **110** includes a digital signal processor (DSP) with software and additional hardware to enable communications with the mobile vehicle and to perform other routines and requested services. In one embodiment, the DSP includes a routine for obtaining and recording positional and date/time information from the GPS unit for a route traveled by the vehicle. Mobile vehicle **110** may have the capability of saving this positional and date/time information to flash memory or RAM or another appropriate onboard system well known in the art.

Mobile vehicle **110** may send radio transmissions to and receive radio transmissions from wireless carrier system **120**. Wireless carrier system **120** may be a wireless communications carrier. Wireless carrier system **120** may be, for example, a mobile telephone system. The mobile telephone system may be an analog mobile telephone system operating over a prescribed band nominally at 800 MHz. The mobile telephone system may be a digital mobile telephone system operating over a prescribed band nominally at 800 MHz, 900 MHz, 1900 MHz, or any suitable band capable of carrying mobile communications. Wireless carrier system **120** may transmit to and receive signals from mobile vehicle **110**. Wireless carrier system **120** may transmit to and receive signals from a second mobile vehicle **110**. Wireless carrier system **120** may be connected with communications network **125**.

Communications network **125** may comprise a mobile switching center. Communications network **125** may comprise services from one or more wireless communications companies. Communications network **125** may be any suitable system or collection of systems for connecting wireless carrier system **120** to a second mobile vehicle **110** or to a call center **150**.

Land network **140** may be a public-switched telephone network. Land network **140** may comprise a wired network, an optical network, a fiber network, another wireless network, or any combination thereof. Land network **140** may comprise an Internet protocol (IP) network. Land network **140** may connect communications network **125** to a call center.

Land network **140**, in one embodiment, connects a first wireless carrier system **120** with a second wireless carrier system **120**. Communication network **125** and land network **140** may connect wireless carrier system **120** to a communication node or call center **150**. The communication delivered to the call center may be, for example, a recording of positional information for a route traveled by the vehicle. The communication may be delivered to call center **150** by vehicle **110** initiating a call to a predetermined number.

Call center **150** may be a location where many calls may be received and serviced at the same time, or where many calls may be sent at the same time. The call center may be a telematics call center, prescribing communications to and from mobile vehicles **110**. The call center may be a voice call center, providing verbal communications between an advisor in the call center and a subscriber in a mobile vehicle. The call center may contain each of these functions. Call center **150** includes hardware and software necessary for providing subscriber carpooling service. The hardware and software includes that which enables the storing of carpool subscriber enrollment information and the comparing of one subscriber's enrollment information to another subscriber's enrollment information in order to provide carpool candidates.

The call center **150** may contain switch **151**. Switch **151** may be connected to land network **140** and may receive a modem signal from an analog modem or from a digital modem. Switch **151** may transmit voice or data transmission from a communication node. Switch **151** may also receive voice or data transmissions from mobile vehicle **110** through wireless carrier system **120**, communications network **125**, and land network **140**. Switch **151** may receive from or send data transmissions to data transmission device **152**. Switch **151** may receive from or send voice transmissions to advisor **155** via bus system **156**.

Data transmission device **152** may send or receive data from switch **151**. Data transmission device **152** may be an IP router or a modem. Data transmission device **152** may transfer data to or from advisor **155**, one or more

communication services managers **153**, one or more communication services databases **154**, and any other device connected to bus system **156**. Data transmission device **152** may convey information received from communication network **130** to communication services manager **153**.

Communication services manager **153** may be connected to switch **151**, data transmission device **152**, and advisor **155** through bus system **156**. The call center may contain any combination of hardware or software facilitating data transmissions between call center **150** and mobile vehicle **110** and between call center **150** and Web site **160**.

Communication services manager **153** may receive information from mobile vehicle **110** through wireless carrier system **120**, communication network **125**, land network **140**, and data transmission device **152**. Communication services manager **153** may send information to mobile vehicle **110** through data transmission device **152**, land network **140**, communication network **125,** and wireless carrier system **120**. Communication services manager **153** may provide information to mobile vehicle **110** from communication services database **154**.

Communication services database **154** may contain records on one or more mobile vehicles **110**. Communication services database **154** may be a central storage location for information received from mobile vehicles **110**. Records in communication services database **154** may include vehicle identification, location information, status information, recorded positional and date/time information for a route traveled by the vehicle, and recent action information regarding mobile vehicle **110**. Communication services database **154** also provides storage for carpool service enrollment information. In one embodiment, the enrollment information is received from the service subscriber through web site **160**. Communication services database **154** may provide information and other support to communication services manager **153**.

Advisor **155** may be a real advisor or a virtual advisor. A real advisor may be a human being in verbal communication with the mobile communication

device of vehicle **110**. A virtual advisor may be a synthesized voice interface responding to requests from the mobile communication device of vehicle **110**. Advisor **155** may provide services to the mobile communication device of vehicle **110**. Advisor **155** may communicate with communication services manager **153** or any other device connected to bus system **156**. Advisor **155** may provide routing assistance and traffic reporting to mobile vehicle **110**.

Call center **150** provides information to Web site **160**. The information provided to Web site **160** may be recorded positional and date/time information for a route traveled by the vehicle. Web site **160** may display this information overlaid on a map. The recorded route displayed on Web site **160** may be capable of modification by an identified user. Modification may be accomplished with dynamic HTML (DHTML), a Java applet, a client-side image map, Active X control, a browser plug-in, or any suitable method. Web site **160** also allows a driver to initiate the request for carpooling service. Web site **160** further provides the interface for a user of the carpooling service to input additional information regarding driving habits, preferences for potential carpoolers as well as any other relevant data. In one embodiment, the interface takes the form of an on-line application questionnaire.

FIG. 2 shows a flow diagram of one embodiment of a method for recording a mobile vehicle route and providing car-pooling assistance using a wireless communication system, in accordance with the present invention at **200**. Car-pooling assistance method **200** comprises steps to record and save positional information for a traveled route, and enable an identified service subscriber to locate potential carpoolers who travel the same or similar recorded route.

In one embodiment, a vehicle driver subscribes to the carpool service by first enrolling with the service (Block **205**). The subscriber enrolls with the service by accessing the carpool web site **160** via a personal computer **170**.

The enrollment process may take the form of answering a series of questions presented, i.e. an enrollment application. The questions may pertain

to the drivers driving habits and the normal route traveled. Additional questions may pertain to driver and passenger preferences and habits. Questions may pertain to, for example, smoking and music preferences and whether the driver has a habit of stopping for coffee on the way to work. Additional questions may pertain to gender, car type (make and model), number of seats in the car, place of employment or school, occupation, and time of day to and from work or school. Other questions may provide details of a more personal nature so that those looking to carpool may find someone with common interests or hobbies. Other questions may pertain to how far the driver is willing to deviate from his normal route in order to accommodate his passengers. Once the enrollment form has been completed, the user transmits the completed form to the call center via the website (Block **210**). In one embodiment, the user simply clicks a "Submit" button present on the web site interface. After transmission of the enrollment information to call center **150**, the information is placed in a subscriber profile located in communication services database **154**.

After a vehicle driver has enrolled with the service, the driver may initiate the system shown in **Fig. 1**, (Block **215**). In one embodiment, this is accomplished by the driver pressing a button inside the vehicle **110**. The button activates the vehicle's onboard digital signal processor **122**, of telematics unit **115** which may respond with an audible signal, for example "Ready". In another embodiment, the user may initiate the system by speaking a word or phrase. For example, the user may speak the word "Activate".

The driver then instructs the system to record a route (Block **220**). To initiate a recording, the driver may issue a voice command, for example "Start recording route." The vehicle's onboard digital signal processor may give an audible response, for example "Recording route." The driver may then begin traveling the route that is to be recorded (Block **225**.)

As the vehicle travels the route, positional information may be obtained at set time intervals (Block **230**). The set time intervals may be 0.05, 0.1, 0.5, 1, 5,

and up to 10 seconds. In one embodiment, the time interval is 1 second. Positional information may continue to be obtained until the route is concluded (Block **235**). In one embodiment, a time stamp is associated with the positional information obtained. In one embodiment, a time stamp is associated with each major intersection encountered along the recorded route. The time stamp provides another parameter for selecting potential carpool occupants. In another embodiment, a date stamp is associated with the recorded route. For example, the date traveled is obtained at the start of recording the route.

In one embodiment, the recorded route is divided into nodes and vertices. The nodes represent intersections and the vertices represent road segments between the nodes. Data attributes associated with each node may include time of day and date the node is traversed. Other data attributes associated with the recorded route may include the speed traveled between the nodes and the length of time to travel the vertices between the nodes.

Once the driver has traveled the entire route, the driver may either save the route information (**240**) or cancel the recording (**242**). Saving the route information may include the driver again pressing the button used to initiate the system, whereupon the onboard digital signal processor may again respond with an audible signal, for example "Ready." The driver may then issue a voice command, for example "Save route." The driver may cancel the recording for a number of reasons. For example, the driver may cancel the route if he unexpectedly went off his normal route while traveling to work due to a road detour or a spur of the moment errand. Upon cancellation, the driver may return to Block **215** at a later date when the route is traveled again in order to record the route.

A nametag may be assigned to the route if the driver indicates that the route should be saved (Block **245**). The onboard digital signal processor may request a nametag for the route, for example by delivering the audible statement

"Route nametag please." At this point the driver may assign the route a name, for example by saying "Home to work." The onboard digital signal processor may then deliver an audible response, for example "Route stored."

The onboard digital signal processor **122** may transmit the route and associated nametag to a central storage location (Block **250**), which may be a communication services database **154** at a call center **150**. This may be accomplished by the onboard digital signal processor initiating a call to a predetermined number through a wireless carrier system **120**, perhaps also involving a communication network **125** and a land network **140**, and delivering the information using a data transmission device **152**. Routes that the subscriber traveled are recorded and placed in a data structure and linked to the subscriber's enrollment application stored in the communication services database **154** at call center **150**. The linked route and subscriber enrollemtn application may be referred to as a subscriber, or user, profile.

The central location may then use this information to update a Web site **160** (Block **255**). After transmission of the route to the website, the driver may view the route information, which may be overlaid on a map, at the Web site and determine whether it is correct (Block **260**).

If the route information requires modification, the driver may modify the route information shown on the Web site using a personal computer **170** or any device through which the Web site may be accessed (Block **265**). Once the subscriber has determined that the information contained for the route and the enrollment profile is accurate, the subscriber confirms the accuracy. In one embodiment, the subscriber clicks an "Enrollment Complete" icon present on the web site interface.

After receipt of a confirmation of the accuracy of the enrollment information system 100 generates a list of potential carpoolers (Block **275**).

Using suitable software the database is searched for potential matches to the route and other criteria submitted by the subscriber. The software may begin

the searching process by finding those other subscribers in the database that travel the same or nearly the same route. In one embodiment this is accomplished by comparing the recorded route nodes and vertices of one subscriber to those of another subscriber route to find compatible subscribers. For example, a first subscriber route having ten nodes is compared to a second subscriber route having nine nodes. Upon comparison of these two routes it is found that eight of the nodes are in common with both of the recorded routes. In this example, the second subscriber would be added to the list of potential subscribers to be sent to the subscriber seeking a carpooler. In one embodiment, the percentage of nodes that are in common with the subscriber's route may be a parameter taken into account when compiling the list if potential carpoolers. For example, a first subscriber may be willing to accept a list of carpoolers that have routes with eight of ten matching nodes but a second subscriber may only accept a list of carpoolers having all ten matching nodes.

After a list is generated containing subscribers with the same or similar routes, the system may next compare the enrollment applications of the list of subscribers. It is here that the system would take into account the preferences of the subscribers to generate the list to be sent to a particular subscriber. The list may include those other subscribers that do not fit a subscribers profile completely but may be within a certain degree of variance.

The degree of variance a particular subscriber is willing to accept as a potential carpooler may be a parameter submitted with the enrollment application. Those with skill in the art will recognize that there are many ways an enrollment application may be structured to elicit the amount of variance a subscriber is willing to accept. The final list to be transmitted may contain as little or as much information a subscriber is willing to have released. In one embodiment the list contains only the name and telephone number of the potential carpooler. In another embodiment the list may also include the e-mail address and/or home address. Those with skill in the art will recognize that this is another parameter that may be chosen at the time of enrollment.

Upon the completion of the searching, the list of potential carpoolers generated (Block **275**) is transmitted to the website (Block **280**). The driver may then retrieve the transmitted list from the website (Block **285**). In one embodiment, the call center may notify the driver that a list has been generated and transmitted to the website. The driver may be notified by electronic mail or may be notified by an audible message sent to the vehicle and broadcast via the vehicle telematics unit. Once the list is retrieved, the subscriber may contact the individual(s) on the list.

Those with skill in the art will recognize that the carpool assistance service may also include those people without transportation looking for a driver to carpool. In this situation, the user would access the appropriate website to enroll into the carpool assistance service program and submit the completed enrollment form. This user would then be provided with a list of drivers that meet her criteria.

While the embodiments of the invention disclosed herein are presently considered to be preferred, various changes and modifications can be made without departing from the spirit and scope of the invention. The scope of the invention is indicated in the appended claims, and all changes that come within the meaning and range of equivalents are intended to be embraced therein.